IDENTIFICATION OF SEX FROM PALATAL BONES USING MULTI-SLICE COMPUTED TOMOGRAPHY SCAN IN A SAMPLE OF ADULT EGYPTIAN POPULATION

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ABSTRACT

Background: Identification is the cornerstone in forensic medicine. Accurate sex identification from fragmented bones is a challenging medicolegal task. The hard palate is a well-protected part in the skull base with sexually dimorphic characters. **Objectives**: This current research aimed to predict sex from palatine bones in a sample of Egyptians using 3D Computed Tomography. **Subjects and methods:** The study included 100 adult Egyptians (47 males, 53 females) who performed skull CT. The studied palatine measurements were Maxillo-Alveolar Breadth (MAB), Maxillo-Alveolar Length (MAL), Incisive foramen - greater palatine foramen (IF-RGPF, IF-LGPF), Incisive Foramen-Basion (IF-B), and Incisive Foramen- mastoid Notch (IF-RMN, IF-LMN). Maxillo-Alveolar Index (MAI) and size of the palate were also calculated. **Result:** Most palatine measurements were higher among males. However, a significant difference was observed among MAB, MAL, IF- RMN, and IF-LMN. These significant measurements were included in regression analysis for sex prediction. The highest accuracy was obtained by an equation including MAL, MAB, IF- RMN, and IF- LMN together (68%) followed by MAL (64%) followed by IF- RMN, IF- LMN and MAB 63%, 61%, 60% respectively. Moreover, Receiver operator characteristic (ROC) curve analysis revealed that the combined parameters (MAL, MAB, IF- RMN, and IF- LMN) were the best sex discriminator (accuracy 68%), followed by MAL (64%) followed by MAB (62%) and IF-LMN (61%).

Keywords: Identification; Sex prediction; Computed Tomography; Palatine bones; Egyptian.

INTRODUCTION

Sex identification is the cornerstone in forensic practice. Accurate sex prediction reduces the probability of the suspected cases to half. Thus correct sex estimation is much more valuable than identification of age, race and stature. **(Darwish et al., 2017; Chalkoo et al., 2020; Elgazzar, et al., 2021)**

The accuracy of sex prediction relies on the integrity of the skeleton and bony remains. The pelvic and cranial bones are considered the most sexual dimorphic parts in the skeletons. **(Selliah et al., 2020; Sobh and Gheat, 2021)**

The skull, especially its base, is one of the most resistant bones that could withstand destructing environmental conditions. Beside, these well-preserved bones contain sexually dimorphic characters that could be used for medicolegal identification. **(Darwish et al., 2014; Saleh et al., 2019)**

The hard palate is the anterior part of the skull base that separates the nasal and oral cavities. It is formed of the palatine process of the maxilla and transverse plate of palatine bones linked by a suture. **(Standring, 2005)**

From a medicolegal perspective, the palatine bones could be used in identification. Racing variation of the palatine bones is well-established in the scientific literature. (**Patel M, 2012; Gangrade et al., 2012; Shalaby et al., 2015).** Also, the fusion of the palatine suture could be used in age identification. **(Hens and Godde, 2020)**

Sexual dimorphism is variances that could differentiate both sexes. The extent of sexual dimorphism is greatly influenced by genetic and environmental factors. Sexual dimorphic characters are population-specific. **(Gangrade et al., 2012; Kirchengast, 2014)**

Several research refer to morphological and anthropometric measurements as convenient and reliable methods for sex determination. Identification based on the metric trait is often more accurate than visual methods. **(Sheta et al., 2015)**

Few osteological studies were concerned with sex determination from the palatine bone parameters in Brazilian **(Suazo et al., 2008)** European **(Bigoni et al., 2010)**, Indian **(Sumati and Phatak, 2012)**, Iraqian populations **(Abdul Ameer and Fatah, 2016).**

In Egypt, a study was conducted to estimate the utility of the palatal bones using dry skulls for sex prediction. **(Shalaby et al., 2015)**

The advancement of the Computed Tomography (CT) scan in forensic medicine allows accurate visualization of the skull base and correct measurement of required dimensions applied for sex estimation. **(Chalkoo et al., 2020; Sobh and Mohamed, 2021).**

Therefore the current study aimed to evaluate the accuracy and the reliability of the palatal bones in sex determination using 3D-CT scan in a sample of Egyptian populations**.**

SUBJECTS & METHODS

The present study was conducted on 100 Egyptian subjects aged between 18 and 61 years (47 male and 53 female participants).

All the subjects were referred to the Radio-Diagnosis Department at Alexandria University Hospitals for performing skull CT scanning for different medical conditions. Subjects with pathological or traumatic skull lesions, apparent deformities were excluded from the study. Any cases with missing maxillary central incisors and maxillary second molars were also excluded from this study.

Approval of the medical ethics committee was obtained. (IRB No: 00012098, FWA No: 00018699, Serial Protocol No 0304885). Informed consent was taken from all participants.

Computed Tomography examinations were conducted using Multi-detector CT machines, including Philips Brilliant-16 (USA) and Siemens SOMATOM Sensation 64 (Germany). CT scanning parameters were as follows: slice thickness, 1 mm. Volumetric High-Resolution CT table speed with least cycles of breath holds as possible. Tube rotation, 0.6 to 0.9 seconds. Detector collimation 1 mm. Helical mode (volumetric High-Resolution CT). Kilovoltage peak and milliampere per slice, 100 to 120 kVp and 200 to 300 mA, according to the type of Multi-slice CT machine used and age of the patient.

Three dimensional reconstructed CT images of palatal bones were analyzed in linear measurements between bony anatomical landmarks, and all these linear measurements were done on the axial section by cm unit.

The study included the following palatal parameters: (Abdul Ameer NA and Fatah AA, 2016) (Sheta A et al., 2015)

A) Linear measurements

- **Maxillo-Alveolar Breadth (MAB):** The maximum breadth of the maxilla measured on the lateral border of the second maxillary molars as shown in (Figure 1).

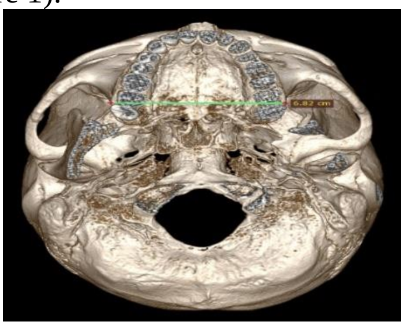

Figure (1): Maxillo-Alveolar Breadth (MAB): The maximum breadth of the maxilla measured on the lateral border of the second maxillary molars.

- **Maxillo-Alveolar Length (MAL):** The distance from prosthion (located between the central incisors) to alveolon (located on the posterior borders of the maxilla in the mid-sagittal plane) (figure 2).

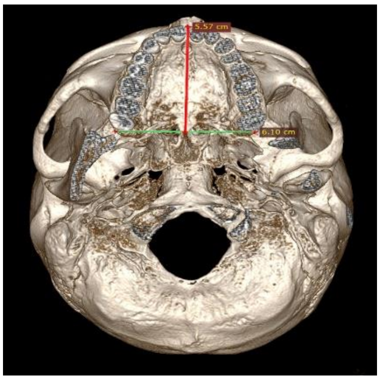

Figure (2): Maxillo-Alveolar Length (MAL): The distance from prosthion (located between the central incisors) to alveolon (located on the posterior borders of the maxilla in the mid-sagittal plane).

- **Incisive foramen - greater palatine foramen (IF-GPF):** The distance between incisive foramen and greater palatine foramen on both sides (right and left) (**IF-RGPF, IF-LGPF**) (figure 3).

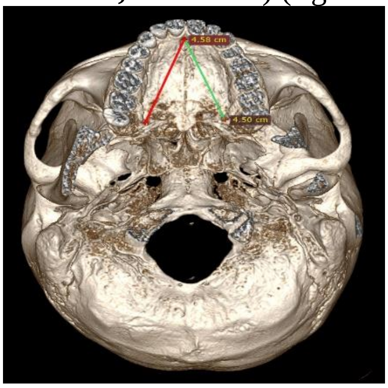

Figure (3): Incisive foramen - greater palatine foramen (IF-GPF) The distance between incisive foramen and greater palatine foramen on both sides (right and left).

- **Incisive Foramen-Basion (IF-B):** The distance between the incisive foramen and the median point of the anterior area of the foramen magnum (Basion point) (figure 4).

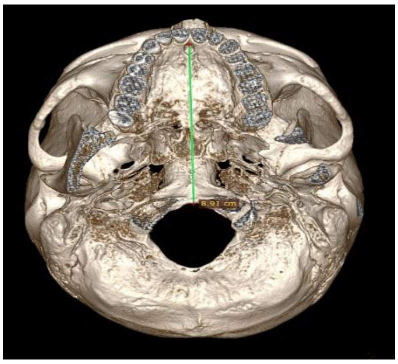

Figure (4): Incisive Foramen-Basion (IF-B) The distance between the incisive foramen and the median point of the anterior area of the foramen magnum (Basion point).

- **Incisive Foramen-mastoid Notch (IF-MN):** Distance between the incisive foramen and the anterior root of the mastoid notch on both sides (right and left) **(IF-RMN, IF-LMN**) (figure 5).

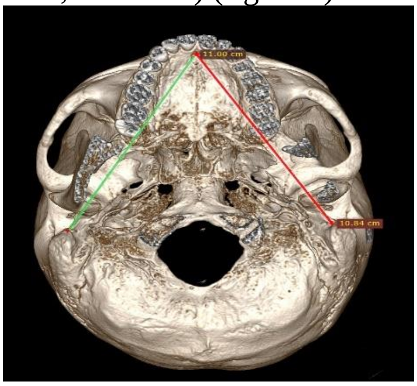

Figure (5): Incisive Foramen- mastoid Notch (IF-MN) (RT,LT) Distance between the incisive foramen and the anterior root of the mastoid notch on both sides

B) Maxillo-Alveolar Index (MAI): This index is obtained by division of maxilla-alveolar breadth on maxilla-alveolar length, then multiplies by 100.

Maxilo-Alveolar Index= MAB/ MAL *100

C) Size of Palate: The size of the palate is calculated by multiplication of Maxillo-Alveolar Breadth and Maxillo-Alveolar Length, and then divided by 100.

Size of palate= MAL * MAB/100

Statistical Analysis:

Data was analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Student t-test was assessed for normally distributed quantitative variables to compare both sexes. A receiver operating characteristic (ROC) curve was used, and the area under the ROC curve denotes the diagnostic performance of the test. Regression equations were formulated to predict the probability of sex identification using logistic regression analysis. If the palatal parameters are applied in the formula and the result of the equation is higher than a cut-off value, the sex was predicted to be male.

RESULTS

This cross-sectional study included 100 Egyptian subjects who performed skull CT. The distribution of the cases was nearly equal between both sexes as males represented 47% of the cases. The ages of the males ranged from 18 to 61 years, with a mean age of 33.91 ± 12.33 years, while that for the females ranged from 20 to 55 years, with a mean age of 31.60 ± 11.31years. No significant difference was observed between both sexes regarding the mean age, where t = 0.978 and *p* = 0.331.

Table 1 illustrates the nine parameters of palatal bones in both sexes. These parameters included Maxillo-Alveolar Breadth (MAB), Maxillo-Alveolar Length (MAL), Incisive foramen - greater palatine foramen (IF-RGPF) (IF-LGPF), Incisive Foramen-Basion (IF-B), Incisive Foramen-mastoid Notch (IF-RMN) (IF-LMN), Maxillo-Alveolar Index (MAI) and size of the palate.

The mean values of all the measurements of the palatals bones were higher among males than those among females except IF-LGPF, MAI. It was observed that MAB, MAL, IF- RMN, IF-LMN were significantly higher in males than in females, where p values were 0.029, 0.017, 0.049 and 0.017 respectively.

Table (1): Comparison between males and females according to the different palatal parameters (n=100)

	Total (n = 100)	Males (n = 47)	Females (n = 53)	t	p
MAB					
Min. – Max.	4.18 – 6.84	5.38 – 6.84	4.18 – 6.48	2.217*	0.029*
Mean ± SD.	5.97 ± 0.41	6.06 ± 0.36	5.88 ± 0.44		
Median (IQR)	5.97 (5.73 – 6.28)	6.09 (5.8 – 6.34)	5.86 (5.72 – 6.17)		
MAL					
Min. – Max.	3.88 – 6.35	4.54 – 6.35	3.88 – 6.18	2.435*	0.017*
Mean ± SD.	5.22 ± 0.52	5.35 ± 0.46	5.1 ± 0.55		
Median (IQR)	5.22 (4.82 – 5.61)	5.39 (5.04 – 5.61)	5.06 (4.8 – 5.53)		
IF-GPF					
IF-RGPF					
Min. – Max.	2.83 – 5.03	2.88 – 4.52	2.83 – 5.03	0.433	0.666
Mean ± SD.	3.76 ± 0.45	3.78 ± 0.39	3.75 ± 0.50		
Median (IQR)	3.77 (3.48 – 4.01)	3.82 (3.56 – 4.01)	3.73 (3.47 – 3.98)		
IF-LGPF					
Min. – Max.	2.76 – 8.43	2.92 – 4.60	2.76 – 8.43	0.297	0.767
Mean ± SD.	3.89 ± 0.63	3.87 ± 0.38	3.91 ± 0.80		
Median (IQR)	3.90 (3.55 – 4.09)	3.94 (3.71 – 4.08)	3.80 (3.55 – 4.15)		
IF-B					
Min. – Max.	3.72 – 9.95	3.72 – 9.83	3.83 – 9.95	1.103	0.273
Mean ± SD.	8.04 ± 0.94	8.15 ± 0.99	7.94 ± 0.89		
Median (IQR)	8.14 (7.70 – 8.51)	8.30 (7.71 – 8.73)	8.01 (7.53 – 8.38)		
IF- MN					
IF- RMN					
Min. – Max.	9.13 – 12.30	9.24 – 12.30	9.13 – 10.99	1.994*	0.049*
Mean ± SD.	10.34 ± 0.57	10.46 ± 0.68	10.23 ± 0.41		
Median (IQR)	10.27 (9.94 – 10.78)	10.49 (9.81 – 11.01)	10.18 (10.03 – 10.5)		
IF- LMN					

Min. – Max.	8.33 – 11.89	8.78 – 11.89	8.33 – 11.14	2.420*	0.017*
Mean ± SD.	10.17 ± 0.70	10.35 ± 0.75	10.01 ± 0.63		
Median (IQR)	10.17 (9.82 – 10.7)	10.37 (9.9 – 10.9)	10.03 (9.81 – 10.4)		
MAI					
Min. – Max.	92.78 – 146.23	92.78 – 137.34	97.14 – 146.23	1.048	0.297
Mean ± SD.	115.12 ± 10.42	113.96 ± 9.68	116.14 ± 11.02		
Median (IQR)	114.6 (107.3 – 123)	113.6 (107.1 – 121.4)	115.09 (108 – 123.3)		
Size palate					
Min. – Max.	4.50 – 9.07	5.01 – 8.64	4.50 – 9.07	0.436	0.664
Mean ± SD.	6.88 ± 0.86	6.92 ± 0.80	6.84 ± 0.92		
Median (IQR)	6.86 (6.4 – 7.4)	7.01 (6.4 – 7.4)	6.75 (6.4 – 7.2)		

t: Student t-test
p: p value for comparing between males and females
***: Statistically significant at $p \leq 0.05$**

Logistic regression model for the probability of sex prediction

The significance of the MAB, MAL, IF- RMN, IF- LMN parameters was further confirmed by the univariate and multivariate logistic regression models. These statistical analyses were carried out to predict the probability of being a male based on studied palatal measurements.

By univariate logistic regression, MAB, MAL, IF- RMN, IF- LMN parameters were significant predictors for sex determination as p values were 0.036, 0.02, 0.047, and 0.021, respectively, as shown in Table 2.

The adopted significant regression equations are illustrated in Table 2. MAL was the most powerful predictor for sex determination with 64% accuracy, followed by IF- RMN, IF- LMN and MAB that predicted sex with 63%, 61%, 60% accuracies, respectively. When the four significant palatal measurements were included in an equation, the accuracy of sex identification increased to reach 68%.

A multivariate logistic regression analysis was formulated and denoted no dominance of any of these parameters over the others as the p-value of each parameter > 0.05, as shown in Table 2.

Table (2): Univariate and multivariate logistic regression analysis for the prediction of the sex

	Sex	**>Cut off = male**	**B**	**p**	**OR (95%C.I)**	**Accuracy**
Univariate Equation	-5.205 + MAL x 0.973	>0.44	0.973	0.020*	2.645 (1.167 – 5.998)	64.0
	-7.915 IF- MN (Right) x 0.754	>0.48	0.754	0.047*	2.125*(1.010 – 4.472)	63.0
	-7.433 IF- MN (Left) x 0.718	>0.47	0.718	0.021*	2.051*(1.116 –3.767)	61.0
	-7.485 + MAB x 1.231	>0.43	1.231	0.036*	3.426*(1.083 – 10.833)	60.0
Multivariate Equation	-12.591+ 0.966 x MAB	>0.5	0.966	0.156	2.627 (0.691 – 9.983)	68.0
	+ 0.437 x MAL		0.437	0.419	1.548 (0.536 – 4.467)	
	+ -0.296 x IF- RMN		-0.296	0.668	0.744 (0.192 – 2.874)	
	+ 0.734 x IF- LMN		0.734	0.164	2.084 (0.741 – 5.861)	

B: Unstandardized Coefficients
OR: Odd`s ratio, C.I: Confidence interval
#: All variables with $p<0.05$ was included in the multivariate
***: Statistically significant at $p \leq 0.05$**

Receiver operating characteristic (ROC) analysis

For more practical application, ROC analysis was used to assess the discriminant ability of the significant palatal measurements. Accuracy is measured by calculating the area under the ROC curve (AUC).

Table 3 reveals that MAL, MAB and IF- LMN were the valid and reliable palatal measurements in sex determination as follows:

- **MAL:** Male sex is predicted at a cut-off point 5.1 cm or more (sensitivity

70.21%, specificity 58.49%, p=0.034, AUC=0.623) with accuracy 64%.

- **MAB:** Male sex is predicted at a cut-off point 5.86 cm or more (sensitivity 72.34%, specificity 52.83 %, p=0.05, AUC= 0.612) with accuracy 62%.
- **IF-LMN:** Male sex is predicted at a cut-off point 10.26 cm (sensitivity 55.32%, specificity 66.04%, p=0.022, AUC=0.633) with accuracy 61%.

The applicability of IF-RMN in sex determination using the ROC curve was below the accepted significance.

Table (3): Validity (AUC, sensitivity, specificity) for the studied palatal parameters to discriminate males (n = 47) from females (n = 53)

	AUC	p	95% C.I	Cut off#	Sensitivity	Specificity	PPV	NPV	Accuracy
MAL	0.623*	0.034*	0.513 – 0.734	>5.1	70.21	58.49	60.0	68.9	64.0
MAB	0.612*	0.05*	0.500 – 0.724	>5.86	72.34	52.83	57.6	68.3	62.0
IF- LMN	0.633*	0.022*	0.521 – 0.744	>10.26	55.32	66.04	59.1	62.5	61.0
IF- RMN	0.594	0.107	0.474 – 0.714	>10.44	53.19	71.70	62.50	63.33	63.0
Combined	0.666*	0.004*	0.560 – 0.773	>0.5	74.47	62.26	63.6	73.3	68.0

AUC: Area Under a Curve **p value: Probability value**
CI: Confidence Intervals
NPV: Negative predictive value **PPV: Positive predictive value**
***: Statistically significant at p ≤ 0.05**
#Cut off was choose according to Youden index

The accuracy of sex prediction using the ROC curve reached 68% when the combined four parameters (MAL, MAB, IF- RMN, IF- LMN) were used together (Sensitivity 74.47%, specificity 62.26 %, p =0.004, AUC= 0.666).

The performance of palatal measurements in the prediction of sex is demonstrated in Fig 6.

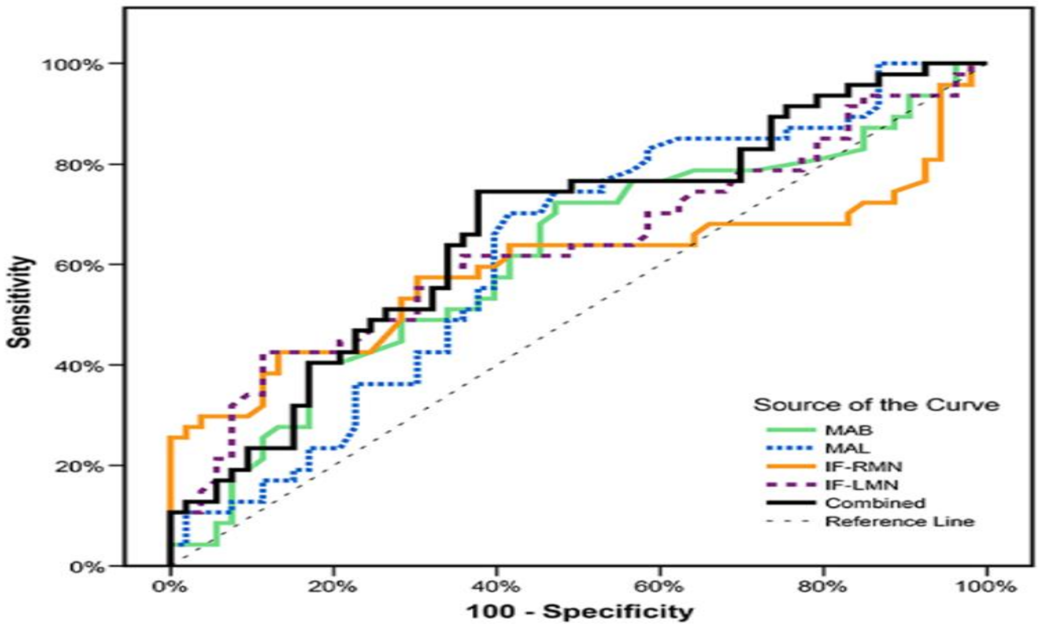

Figure (6): ROC curve for the performance of different palatine parameters in the sex prediction.

DISCUSSION

Sex identification of mutilated corpses and skeletal remains is a challenging task in forensic anthropology and legal medicine. The approach for the identification relies on the available remnants and their integrity. The entire skeleton is better in sex prediction rather than separate bone. However, a whole skeleton is rarely found in most situations, including mass disasters. Therefore, identifying the dimorphic bones in the skeleton would be a feasible solution for reliable sexing. **(Chalkoo. et al., 2020' Najem et al., 2021)**

The hard palate is usually found as a part of skeletal remains even in mass causalities, fire accidents and explosions due to its hard resistant nature and well-preserved position in the skull base. **(Gapert et al., 2009; Kamath et al., 2016).**

Researches were conducted to identify sex from the hard palate using dry skulls, and their result pointed to sexual dimorphic characters of palatine bones**. (Sumati and Phatak, 2012; Patel, 2012)**

To date, only one research used hard palate in sex identification on virtual skulls in the Iraq population. Therefore, this study investigated the palatine bone parameters as reliable sex predictors using virtual skulls. **(Abdul Ameer and Fatah, 2016**)

The anthropological characters are population-specific. **(Gangrade et al., 2012).** Therefore, the present work included 100 Egyptian subjects who performed CT on the skulls. These measurements were obtained on 3D reconstructed CT images.

These parameters included Maxillo-Alveolar Breadth (MAB), Maxillo-Alveolar Length (MAL), Incisive foramen-greater palatine foramen (IF-RGPF) (IF-LGPF), Incisive Foramen-Basion (IF-B) and Incisive Foramen-mastoid Notch (IF-RMN) (IF-LMN). Also, Maxillo-Alveolar Index (MAI) and palate size were calculated.

In the current study, it was observed that mean of seven measured parameters (MAB, MAL, IF-RGPF, IF-B, IF-RMN, IF-LMN and size of palate) were higher among males than females. This observation could be explained by the larger male skulls in relation to that of females. Other craniometric studies rely on the same principle for sex identification. **(Sherif et al., 2017; Sobh and Gheat, 2021).**

In 2016, **Abdul Ameer and Fatah (Abdul Ameer and Fatah, 2016**) conducted a similar radiological study in the Iraq population. They found that all the palatine parameters were higher among males than the females, which is in agreement with the present work.

Different osteological studies conducted on various populations concluded that most palatal parameters were higher in males than females. However, the variation of the methodologies and measured palatal parameters challenge the comparability of the results. (**Patel, 2012; Gangrade et al., 2012; Nascimento et al., 2012; Moreira, 2008; Sumati and Phatak, 2012).**

In the current study, Maxilla-Alveolar Index (MAI) was higher in females than males. In Indian populations, two osteological studies conducted by **Patel** (**Patel, 2012),** Sumati and Phatak **(Sumati and Phatak, 2012)** revealed that MAI was higher in females than males. Similarly, radiological research conducted by **Abdul Ameer and Fatah (Abdul Ameer and Fatah, 2016**) in the Iraq populations found that MAI was higher in Iraqi females, that is in agreement with the present work.

Regarding statistical significance, the current study verified the statistical significance of the studied palatine parameters. It was noticed that MAB, MAL, IF- RMN, IF-LMN were significantly higher in males than females. Therefore, these parameters were further included in regression models in sex prediction.

It worse mentioned that the distance between incisive foramen - greater palatine foramen (IF-GPF) on both sides and size of the palate did not show a significant difference between both sexes in the current study. These palatine parameters were not previously investigated in a similar radiological study.

Nevertheless, osteological studies elucidated a significantly longer IF-GPF in males than females in different populations. Moreira et al **(Moreira et al., 2008)**, Nascimento et al (**Nascimento et al., 2012),** Tomaszewska et al **(Tomaszewska et al., 2014**) and Shalaby et al **(Shalaby et al., 2015)** found a significant higher IF-GPF in males than females in Brazilian, European, and Egyptian populations.

As regards the size of the palate, Roger **(Rogers, 2005)** and Sumati, Phatak **(Sumati and Phatak, 2012)** demonstrated a significant difference in the palate size between sexes using dry skulls of Canadian and Indian populations. The observed variation in the results could be attributed to the difference in methodologies, genetic and racial differences **(Suazo et al., 2008)**.

The adopted significant regression equations were formulated in the present study. Maxillo-Alveolar Length was the most powerful predictor for sex determination with 64% accuracy. However, other osteological studies proposed a nother palatine parameters as the most powerful indicator for sex prediction.

In Brazilian populations, Nascimento et al (**Nascimento et al., 2012)** stated that Incisive Foramen-Basion distance is the most accurate measurement for sex prediction with 63% accuracy. In Indian populations, Gangrade et al **(Gangrade et al., 2012)** Sumati and Phatak **(Sumati and Phatak, 2012)** referred to palate breadth and size of the palate as the most precise parameters with accuracies 66.7% and 70%, respectively.

In Egyptian populations, Shalaby et al **(Shalaby et al., 2015)** concluded that Maxillo-Alveolar Breadth was the most precise sex determinant.

The current study included the four significant parameters (MAL, MAB, IF-RMN, and IF-LMN) in a significant regression model that could predict sex with 68% accuracy. Another radiological study in the Iraq population found that MAB and IF-B could predict sex with 94% accuracy **(Abdul Ameer and Fatah, 2016**), the observed differences in the results could be attributed to genetic and racial factors.

Whereas Sheta et al **(Sheta et al., 2015)** measured IF-RGPF, IF-LGPF, B-IF along with right greater palatine foremen – left greater palatine foremen (RGPF-LGPF) to predict sex with 94.1% accuracy. The variations in methodology between the current study and Sheta et al. could stand behind the differences in accuracy of sex determination from palatine parameters in Egyptians.

In the current study, ROC curve analysis was also implemented to assess the predictive power of the palatine measurement for sex determination. MAL was the best sex predictor with 64% accuracy, followed by IF- RMN, MAB and IF- LMN with accuracies of 63%, 62%, and 61%, respectively.

The accuracy of sex prediction using the ROC curve reached 68% when the combined four parameters (MAL, MAB, IF- RMN, and IF- LMN) were used together with AUC = 0.666. Another radiological study in the Iraq population pointed to palate size as the best sex predictor using ROC curve analysis with AUC=0.955. **(Abdul Ameer and Fatah, 2016**)

Taking into consideration that sex could be estimated from the whole skull with 80% accuracy **(Saukko and Knight, 2016), t**he current result pointed to the hard palate as a reliable sex predictor, which agrees with another research. **(Bigoni et al., 2010; Abdul Ameer and Fatah, 2016**)

In Egypt, many radiological studies on the skull were conducted to identify sex using CT on maxillary sinus, mastoid process, piriform aperture and paranasal sinuses with accuracies 70%, 85%, 82% and 77%, respectively. **(Amin and Hassan 2012; Allam and Allam 2016; Abdelaleem S et al., 2016; Sherif et al., 2017)**

The current study provides an easily applicable radiological method with a relative degree of accuracy for sex estimation in a sample of the Egyptian population. It also reveals the importance of the palatal bone as fragmented bone in sex estimation. However, similar studies using a larger sample size are recommended on different populations.

CONCLUSION

This research investigated the palatine parameters as measurements for sex estimation in a sample of Egyptians. The regression analysis and the ROC curve revealed that the palatine parameters (MAL, MAB, IF-RMN, and IF-LMN) are useful indicators for sex prediction in Egyptians. CT scan is a reliable tool for sex estimation from palatine bones.

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تحديد الجنس من عظام الحنك باستخدام التصوير المقطعي متعدد الشرائح في عينة من المصريين البالغين

المقدمة : تحديد الهوية هو حجر الزاوية في الطب الشرعي. يعد التحديد الدقيق للجنس من العظام المتفتتة مهمة طبية قانونية صعبة.عظام الحنك هو جزء محمي بشكل جيد في قاعدة الجمجمة ويحتوى على سمات ثنائية الشكل جنسيا.

الأهداف: يهدف هذا البحث إلى التنبؤ بالجنس من عظام الحنك في عينة من المصريين باستخدام التصوير المقطعي ثلاثي الأبعاد.

الأشخاص والطرق: اشتملت الدراسة على 100مصريين بالغين (47 ذكور و 53 إناث) قاموا بإجراء تصوير مقطعي على الجمجمة. كانت القياسات الحنكية المدروسة هي عرض الفك العلوي (MAB) ، وطول الفك العلوي- (MAL)، والثقبة القاطعة - الثقبة الحنكية الكبرى (IF-RGPF، IF-LGPF) ، الثقبة القاطعة- الباسيون (IF-B) ، الثقبة القاطعة - شق الخشاء (IF-RMN، IF-LMN). تم أيضًا حساب حجم الحنك.

النتيجة: كانت معظم القياسات الحنكية أعلى بين الذكور. لوحظ فروق ذات دلالة إحصائية بين الذكور والإناث لكلا من عرض الفك العلوي (MAB)، وطول الفك العلوي (MAL) والثقبة القاطعة - شق الخشاء الأيمن والأيسر (IF-RMN و IF-LMN). تم ضم هذه القياسات ذات دلالة إحصائية في تحليل الانحدار للتنبؤ بالجنس. تم الحصول على أعلى دقة من خلال معادلة تضمنت الأربع قياسات معًا بنسبة دقة (68٪) تليها طول الفك العلوي (MAL) (64٪) تليها الثقبة القاطعة - شق الخشاء الأيمن (IF- RMN) و الثقبة القاطعة - شق الخشاء الأيسر (IF- LMN) وعرض الفك العلوى (MAB) بنسبة دقة 63٪ ، 61٪ ، 60٪ على التوالي. علاوة على ذلك ، كشف منحنى روك (ROC) أن القياسات الاربع (IF-LMN & IF-RMN & MAB & MAL) كانت أفضل مميّز للجنس (دقة 68٪) ، تليها طول الفك العلوي (MAL)(64٪) تليها عرض الفك العلوى (MAB) (68٪) و الثقبة القاطعة - شق الخشاء الأيسر (IF- LMN) (61٪).